

## General Ground Water Summary

The northern area of Lake County is situated in the Calumet Lacustrine Plain. This drift consists of between 40-175ft of Wisconsin Glacio lacustrine sand and gravel in the form of long-terraced dunes, bars and beach ridges. The soil in this area is in the Oakville-Tawas association which consists of fine to medium sand with scattered deposits of organically rich Tawas silty deposits. Areas South near the Little Calumet river originate in the Valparaiso Moraine. This drift consists of sand with incontinuous deposits of silt and waterlaid clay, this clay layer is very thick in some areas. Alluvial silt is deposited in and around the Little Calumet River. As the distance South increases, the frequency of clay and silt deposits also increase. There are numerous infiltration areas also scattered throughout the area. In the Northeastern portion of Lake County, 300-625 ft of Ordovician Dolomitic limestone, sandstone and shale directly underly the surficial drift. Very few wells are drilled into this formation because of poor water quality. As the distance East increases a narrow layer of Silurian dolomitic limestone in the Wabash formation overlies the Ordovician layer, these two layers of bedrock are separated by a layer of shale. The Wabash formation is jointed and holds water so more wells are drilled into this formation. In central and eastern Lake County a layer of Devonian Antrim and Ellsworth shale overlies the aforementioned Silurian layer. The aquifer generally flows on a low gradient northeast toward Lake Michigan, near the Grand and Little Calumet Rivers aquifer flow may be multidirectional depending upon seasonal differences and precipitation. The potential for ground water contamination in Northern Lake County is high for both the upper and lower aquifers due to the high permeability of the subsurface which along with the heavy precipitation causes the strong downward component to the area groundwater which could cause downward migration of contaminants to the lower aquifer before lateral movement occurs. Drinking water wells do exist in southern Gary and Black Oak. Some slightly accurate well logs and well location maps are available. A public water supply distribution map will be available by next week. This map will allow you to confirm residents that do not use ground water for drinking purposes.  
(ref 2,3,4,7,8,9,)

EPA Region 5 Records Ctr.



304070



## Surface Water Information

### Intake Locations:

All intakes are located in Lake Michigan.

Borman Park- located due north of Madison St. approximately 1 mile offshore in 40ft of water.

Ogden Intake- located about 12 mi. east of Borman Park intake, Between west end of Ogden Dunes and east limit of west beach. (Latitude 87 12' 12.13" and Longitude 41 37' 56.73") approximately 1/2 mile offshore in 20 ft of water.

-Each intake has its own filtration plant and the system is blended, the Borman Park intake rate is 54 million gallons/day the Ogden intake rate is 24 million gal/day. These intakes directly serve 188,000 people. Gary, Portage, Hobart and Merriville are directly served by these intakes (Gary-Hobart Water Co.). Gary-Hobart also sells its water wholesale to Schererville, Griffith, Ogden Dunes and City of Lake Station. Two small utilities that these intakes serve are Turkey Creek Utilities and Lincoln Gardens Utilities. (ref's 1,36)

-Hammond also has two intakes that directly serves 105,900 people. Hammond intakes also serve:

<u>city</u>	<u>pop.</u>
-Munster.....	93,714
-Highland.....	23,696
-Chicago Heights....	37,200
-Lansing.....	29,039

-approximately 5,000 residents in Black Oak receive their water from Hammond

These intakes pump out approximately 50 mgd and are located to the north of Hwy. 41 near their respective aqueducts (see enclosed handout). (ref's 37-40)

-Whiting has two intakes approximately 1400-1500 ft. offshore east of filtration plant, the intakes are in about 18 feet of water.

-These intakes serve about 5,600 people

-Intakes are owned by Amaco (42)

-East Chicago has an intake east of the aqueduct, about 1.8 miles offshore, in about 28-29 ft. of water.

-This intake serves about 39,786 people. (50)

-South Chicago has four intakes (gates: rectangular, angular openings about 5 feet wide by 7 feet high) in about 23 feet of water east of 77th street about 10 feet offshore

-summer pumping rate is approximately 800 mgd

-winter pumping rate is approximately 480 mgd

-area served by this intake: south of 38th street and includes 47 suburbs

-the total population served is approximately 3.8 million people (49)



**Ground water populations:**

**Indiana:**

**Whiting, Hammond and East Chicago** have no drinking water wells in use (ref's 1,36,38,42,44)

**Some drinking water wells do exist in the Black Oak section of Gary**  
**Gary-Hobart water distribution map shows the members of the Black Oak community that are served by surface water, some residents of the area are served by Peoples Water Corp. (Hammond)—this area is bounded by 21st Street to just south of the expressway and Cline and Burr Streets.**

**There are 30 residences in the area served by Peoples Water Corp still drinking ground water**

**6 residences are just north of 21st Street on 20th Ave.**

**12 residences are on 29th Street between Cline Street and EJ&E RR**

**12 residences scattered throughout the area**

**Any areas in Black Oak not served by the Gary-Hobart Water Co. (surface water distribution map is available) or in aforementioned area served by People's Water Corp. are served by ground water. (ref's 1,36,37,43)**

**Hobart: 10 homes in southeast subdivision of Duck Creek are served by ground water wells (33)**

**Griffith: 6 residences are served by ground water wells (scattered about and at outskirts of town) (31)**

**Highland: Fewer than 20 residences served by ground water wells are scattered throughout the town (32)**

**Merriville: Ground water populations exist in center and northern areas of town, some wells exist south of Route 30, subdivisions of Grassfield, Grassmeadows, and Sandpiper are served by groundwater wells (34)**

**Munster: 10 residential wells are still in use and are scattered throughout area (35)**

**Lake Station: 16,000 residents are served by the town's 4 municipal wells located on Union St., Vigo St., 28th Ave., and 27th Ave. Lake Station is hooked up to the Gary-Hobart system as a backup system, the area from I-65 to State St. is served by New Chicago (51)**

**Ross: 80% of the 37,000 residents are served by the Gary-Hobart system, Eastern Ross (Colorado St. to the county line) is served by approximately 100 drinking water wells (52)**

**New Chicago: All of the 2,581 residents are served by the Gary-Hobart Intake system (53)**

**Scherrerville: Of the 20,000 residences there are about 100 residences still using ground water in the central to north central area of town and the Sherland Park subdivision as well as a small subdivision off of Kennedy (67)**



## Illinois:

-Alsip: 18,200 people served by South Chicago intakes with exception of 4 buildings served by ground water wells on 127th Street between Costner and Cicero (12)

-Blue Island: 21,203 served by Chicago intake system, no ground water use in city (13)

-Calumet City: 40,000 served by surface water in Chicago, no ground water is used for drinking purposes (30)

-Calumet Park: Most of 8,419 residents are on surface water from Chicago, 7 residents on Vermont Street between Aberdeen and Throup Streets are using residential wells, also on ground water are two businesses, one on Ashland near 128th Street, and the other on Vermont Street north (14)

-Crestwood: Most of 10,823 residents receive surface water from Alsip system, 12 homes throughout community are served by private wells (15)

-Dixmoor: The 3,647 residents are served by water purchased from Harvey, one well exists in local forest preserve (16)

-Dolton: Most of the 24,900 residents are served by surface water from Chicago, 20 homes scattered throughout city are not on the system (17)

-Evergreen Park: All of the 22,260 residents are served by the Chicago intake system, the only drinking water well is at 9837 Pulaski. (18)

-Glenwood: Most of 9,289 residents are served by water from Chicago Heights (Hammond), some ground water is used by Cottage Grove and Lansing, Glenwood and Lansing and some on N. Main Street (19)

-Harvey: The majority of the 32,000 residents are served by the Chicago intake system, there are some wells in the southeast section of Harvey (South of 159th Street and East of the RR tracks—this area is gradually converting to surface water so no concrete numbers are available) (20)

-Homewood: Most of the 19,700 residents are served by the Chicago intake system, there are 20-25 houses on private wells of which 80% are located on 185th Street (21)

-Lansing: Most of the 32,000 residents are served by surface water from the Chicago intake system, 10 residences in the southeast end of town use well water for drinking purposes in the Peters subdivision (54)

-Markham: Most of the 13,136 residents are served by the Chicago surface water system, approximately 20-30 homes still use ground water for drinking although these homes are slowly converting to surface water (22)

-Marionette Park: All of the 2065 residents are served by the Chicago surface water system (23)



-Oak Forest: All of the 26,203 residents are on the Chicago surface water system (24)

-Oak Lawn: All of the 60,000 residents are on Chicago surface water (25)

-Riverdale: All of the 13,600 residents receive their water from the Chicago Surface water system (26)

-Robbins: All of the 7,498 residents receive their water from the Chicago surface water system (27)

-South Holland: Most of the 22,105 residents are served by the Chicago intake system, 13 houses on Riverside and Penny Streets are still on ground water (28)

-Thornton: All of the 2,778 residents are supplied with water from South Holland noone is served by ground water (29)

#### Surface Water Information:

The Grand Calumet River has a hydrogeologic divide at White Oak Blvd, West of White Oak Blvd., The Grand Cal flows West; East of White Oak Blvd., the Grand Cal flows East. The Grand Calumet flows East and out the Indiana Harbor Canal, but the direction of the flow of this area of the Grand Calumet and the flow of the Indiana Harbor Canal is dependent upon water levels of Lake Michigan. The water levels of Lake Michigan can change drastically (18") in a period as short as 24 hours. The end result is that the Grand Calumet flows out of the Indiana Harbor Canal about 50% of the time. If the level of Lake Michigan is high enough all of the water can flow West past the divide and the Indiana Harbor Canal directly into the Little Calumet River. U.S. Steel discharges 350 MGD near the mouth of the Grand Calumet, Gary Sanitary District discharges 60 MGD, and Inland Steel 390 MGD making the flow 900 cfs at some outfalls at the easternmost points of the Grand Calumet River. The east arm of the Little Calumet River, Deep River, and all of the West arm of the Little Calumet River east of Griffith discharge into Lake Michigan through the Burns Waterway. Burns Ditch is the western arm of the Little Calumet River. There is also a hydrogeologic divide in the Little Calumet River depending upon the water level in Lake Michigan, the higher the water level, more water will flow West. (ref's 44-47)

#### Fisheries:

The West arms of the Grand and Little Calumet Rivers offer poor aquatic habitat due to heavy input from industrial and domestic pollution. Only rough fish populations exist (mostly bottom feeders such as Carp and White Suckers). Fishing has been reported along both rivers, even though warning advisories exist on amount of fish that should be consumed. Fishing occurs regularly on the beach and pier at Indiana Dunes State Park and Indiana Dunes National Lakeshore. Boat fishing also occurs regularly on Lake Michigan. (ref's 4,6,8)

Lake Michigan has commercial fisheries as well as recreational fishing.

- coho and chinook salmon
- steelhead
- brown trout



-yellow perch

Direct contact with water occurs at Indiana State Park and National Lakeshore and at other municipal beaches. A portion of the beach has been closed down several times in the last two years as a result of constant water monitoring. Dunes State Park has not been shut down within the last two years due to chemical contamination. (2)

**Sensitive Environments:**

- Indiana Dunes State Park and National Lakeshore and forest preserves near Lake Calumet
- There are wetlands along Grand and Little Calumet Rivers, Cedar Lake, Lake George near Milling and Hobart, and near Wolf Lake. 53% of Dunes Creek and Derby Ditch are used for park and wetlands.
- Wetlands Location maps are available for the area which encompasses all Indiana driveby PAs.
- Endangered Species in Lake Co. include the Pitchers Thistle located in Lakeshore dunes and blowout areas in Lake and Porter counties. (6)
- Endangered Species in Cook Co. include the Piping Plover (lakeshore beaches), the Prairie Bush Clover and Prairie Fringed Orchid (prairies), and Peregrine Falcons use areas in Cook Co. for breeding purposes (6)

**Precipitation:**

- Mean annual precipitation across lakeshore ranges from 36 inches in West to greater than 40 inches in the East. Maximum: April and Minimum: February.

**Flows: (average)**

- Grand Calumet: Indiana Harbor 25 cfs  
Near US Steel 550 cfs
- Little Calumet: Lake George 89 cfs  
Gary 14.6 cfs  
South Holland 154 cfs
- Burns Ditch: 126 cfs (48)

FEMA floodplain maps and National Wetlands Inventory maps are available for all areas encompassing Indiana PAs.



### Sewer and Storm Drain Info

**Burnham:** The area West of the Little Calumet has a combined sanitary and storm sewer system, The Eastern area (1/3) of the town has separate sanitary and storm sewers. There are 3 outfalls where the storm water enters the Little Calumet River, 142nd and Mackinaw, Green Bay and Entry Ave, and the end of 138th Pl. (55)

**Calumet City:** Most of city has combined storm and sanitary system, there are 2 storm retention basins located near 142nd and Yates, from there the storm water enters the Little Cal in the vicinity of Paxton Ave. (56)

**Chicago:** All of the city limits have a combined storm and sanitary system, except the lakeshore where the storm sewers empty directly into Lake Michigan (58)

**Dolton:** East Dolton has combined sanitary and storm sewers West Dolton has separate storm and sanitary sewers. The storm sewer discharge point is the Little Calumet on Riverside Dr. between Atlantic and Princeton and there is a sewer discharge point on Sibley at Wentworth (59)

**East Chicago:** The majority of the city has a combined storm relief system (bypass), 2 sections of East Chicago have separate sanitary and storm sewers (Roxanne subdivision between Indianapolis Blvd. on East and White Oak on West and corporate boundary on South, and the other area is Canal St. on South and East side, Indiana Harbor Canal and George Canal on North, and the Harbor Canal on the West); the northwest outfall is located at Canal St. and Indiana Harbor Canal, an outfall at the toll road crosses the river, and two area that discharge into the East and West branch of the Grand Calumet. (64)

**Glenwood:** Sanitary and storm sewers are separate, Two storm sewers discharge into Count Forest Preserve on Northeast end of town, one discharges into Thorn Creek near Science Rd., one discharges into Thorn Creek just East of Arguilla Park, one discharges into Deer Creek North of Main Street. (60)

**Highland:** Storm drainage in Highland is divided into 4 sections, the first outfall is located just East of Indianapolis Blvd. and the Little Calumet River, the 2nd storm takes care of parts of Kennedy Ave and parts of western subdivision, the outfall is located at Kennedy Ave and the Little Cal, the 3rd storm takes care of the majority of the city, the outfall is located at the end of 5th St., the 4th outfall is located at Grace St. and North Dr. (65)

**Homewood:** The storm and sanitary sewers are not connected, the storm sewers run into Butterfield Creek South of 191st from Halsted to Kedzie, from a retention basin to the Little Calumet, storm sewers also flow along the west end of the Illinois Central train tracks then North into Hazelcrest (East of Dixie and West of Ashland) (61)

**Lake Station:** The city has separate storm and sanitary sewers, runoff enters Deep River at 27th St. (51)



**Lansing:** Most of Lansing has separate storm and sanitary sewers with the exception of a small area in the center of town, the storm sewers lead to the Grand Calumet where there are approximately 20 outfalls, these outfalls are located around Burnham Ave, Wentworth Ave., and Bernice Ave., 10 of the 20 outfalls are located between these streets (54)

**Munster:** Areas of combined and separate storm and sanitary sewers exist in Munster, the storm sewers in the southwest (South of Western railroad tracks, West of Columbia) part of town discharge west into the Illinois (Lincoln and Lansing) ditch system, everything North of the Western railroad tracks and East of Columbia discharges into the Hart Ditch which in turn discharges into the Little Cal. (66)

**New Chicago:** The City has separate storm and sanitary sewers, the storm sewers flow into Deep River which flows into Burns Ditch, there are 4 outfalls, one at Indiana Street where it intersects Deep River, one flows West into ditch and then into Deep River at Garfield and Indiana St., one is at Iowa St. and Indiana St., one at Ohio St. where it intersects Deep River (53)

**Oak Lawn:** Storm and sanitary systems are separate, the storm sewers discharge into Oak Lawn Lake and Stony Creek by 110th and Cicero, and central and 105th, and also Ridgeland at 102nd. (62)

**Riverdale:** Riverdale has combined sanitary and storm sewers, the storm discharge points are located at Passetter, near Lake Steel, one outfall is located on the Cal Sag River between 130th near Perry St. and one outfall is located at 130th and Halsted. (63)

**Scherrerville:** Storm and Sanitary sewers are separate, the drainage ditch runs through Highland and runs into Hart Ditch which in turn runs into the Little Calumet River (67)



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Table 2. Land Area and Population: 1930 to 1980

[Counts relate to counties as defined at each census. For meaning of symbols, see Introduction]

## Counties

Counties	1980 land area		Population									
	Square miles	Square kilometers	1980			Percent change		1970	1960	1950	1940	1930
			Number	Per square mile	Per square kilometer	1970 to 1980	1960 to 1970					
The State	55 645	144 120	11 426 518	205.3	79.3	2.8	10.2	11 110 285	10 081 158	8 712 176	7 897 241	7 430 654
Adams	652	2 206	71 622	84.1	32.5	1.1	3.5	70 861	68 467	64 690	65 229	62 784
Alexander	736	2 412	12 264	32.0	20.8	2.1	-25.2	12 015	16 061	20 316	25 496	22 542
Anderson	377	976	16 224	43.0	16.6	15.8	-0.3	14 012	14 060	14 157	14 540	14 406
Armstrong	282	730	26 630	101.5	39.2	12.5	25.2	25 440	20 326	17 070	15 202	15 076
Bureau	306	793	5 411	17.7	6.8	-3.1	-10.0	5 586	6 210	7 132	8 053	7 892
Bureau	869	2 251	39 114	45.0	17.4	1.5	2.5	38 541	37 984	37 711	37 608	36 845
Bureau	250	647	5 867	23.5	9.1	3.4	-4.3	5 675	5 933	6 098	6 207	6 034
Calhoun	444	1 151	18 779	42.3	16.3	-2.6	-1.2	19 276	19 507	18 976	17 987	18 433
Carroll	374	969	15 084	40.3	15.6	6.1	-2.2	14 219	14 539	15 097	16 425	16 537
Champaign	998	2 585	168 392	168.7	65.1	3.1	23.3	163 281	132 436	106 100	70 578	64 273
Christian	710	1 838	36 446	51.3	19.8	1.4	-3.4	35 948	37 207	38 616	38 564	37 538
Clark	505	1 309	14 913	33.5	12.9	4.3	-2.0	16 216	16 546	17 562	18 842	17 672
Clay	469	1 215	15 283	32.6	12.6	3.7	-6.8	14 735	15 015	17 445	18 947	16 155
Clayton	472	1 223	32 617	69.1	26.7	15.2	17.8	28 315	24 029	22 594	22 912	21 369
Coles	509	1 318	52 260	102.7	39.7	9.3	11.6	47 815	42 860	40 328	38 470	37 315
Cook	958	2 481	5 253 655	5484.0	2117.6	-4.4	7.1	5 493 766	5 129 725	4 508 792	4 063 342	3 982 123
Crawford	446	1 154	20 818	46.7	18.0	5.0	-4.5	19 824	20 751	21 137	21 294	21 085
Cumberland	346	896	11 062	32.0	12.3	13.2	-1.7	9 772	9 936	10 496	11 698	10 419
De Kalb	634	1 641	74 624	117.7	45.3	4.1	38.6	71 654	51 714	40 781	34 388	32 644
De Witt	397	1 027	18 108	45.6	17.6	6.7	-1.6	16 975	17 253	16 894	18 244	18 596
Douglas	417	1 080	19 774	47.4	18.3	4.1	-1.3	18 997	19 243	16 706	17 590	17 914
Du Page	337	872	658 835	1955.0	755.5	35.0	55.7	487 966	313 499	154 599	103 480	91 998
Edgar	623	1 613	21 725	34.9	13.5	0.6	-4.3	21 591	22 550	23 407	24 430	24 946
Edwardsville	223	577	7 961	35.7	13.8	12.3	-10.7	7 090	7 940	9 056	8 974	8 300
Effingham	478	1 238	30 944	64.7	25.8	25.7	6.5	24 608	23 107	21 675	22 034	19 013
Fayette	709	1 836	22 167	31.3	12.1	6.8	-5.4	20 752	21 946	24 582	29 199	23 487
Fayette	486	1 258	15 265	31.4	12.1	-6.8	-1.3	16 382	16 606	15 901	15 007	15 489
Franklin	414	1 072	43 201	104.4	40.3	12.7	-2.4	38 329	39 281	48 685	53 137	59 442
Fulton	871	2 256	43 687	50.2	19.4	4.3	-0.1	41 900	41 954	43 716	44 637	43 983
Gallatin	325	841	7 590	23.4	9.0	2.3	-2.9	7 418	7 638	9 618	11 414	10 091
Greene	543	1 407	16 661	30.7	11.8	-2.1	-2.6	17 014	17 460	16 652	20 292	20 417
Grundy	423	1 095	30 582	72.3	27.9	15.3	18.7	26 535	22 530	19 217	18 398	18 678
Hamilton	436	1 129	9 172	21.0	8.1	5.9	-13.4	8 665	10 010	12 254	13 454	12 995
Hancock	795	2 060	23 877	30.0	11.6	0.9	-3.7	23 664	24 574	25 790	26 297	26 420
Harris	181	468	5 383	29.7	11.5	9.5	-16.4	4 914	5 879	7 530	7 739	6 955
Harrison	373	964	9 114	24.4	9.4	7.8	2.6	8 451	8 237	8 416	8 949	8 778
Henderson	824	2 133	57 968	70.3	27.2	8.9	7.9	53 217	48 317	46 492	43 798	43 851
Henderson	1 118	2 896	32 976	29.5	11.4	-1.7	-0.1	33 532	33 562	32 548	32 494	32 913
Jackson	590	1 528	61 522	104.3	40.3	11.8	30.5	55 008	42 151	38 124	37 920	35 688
Jasper	496	1 284	11 318	22.8	8.8	5.4	-5.3	10 741	11 346	12 266	13 431	12 809
Jefferson	570	1 476	36 552	64.1	24.8	14.8	-1.4	31 848	32 315	35 892	34 375	31 034
Jerry	373	965	20 538	55.1	21.3	11.1	8.6	18 492	17 023	15 264	13 636	12 556
Jo Daviess	603	1 561	23 520	39.0	15.1	8.1	-0.3	21 766	21 821	21 459	19 989	20 235
Johnson	346	897	9 624	27.8	10.7	27.5	9.0	7 550	6 728	6 729	10 727	10 208
Kane	524	1 358	278 405	531.3	205.0	10.9	20.5	251 005	288 246	150 388	130 204	125 327
Kankakee	678	1 757	102 926	151.8	58.6	5.6	5.6	97 250	92 063	73 524	60 877	50 095
Kendall	322	835	37 202	115.5	44.6	41.1	50.4	26 374	17 540	12 115	11 105	10 555
Knox	720	1 865	61 607	85.6	33.8	1.1	-0.6	60 939	61 280	54 346	52 250	51 336
Lake	454	1 177	440 372	970.0	374.1	15.1	30.3	382 638	293 654	179 097	121 094	104 387
La Salle	1 139	2 950	112 033	98.4	38.8	8.6	0.5	111 409	116 800	100 610	97 801	97 695
Lawrence	374	969	17 807	47.4	18.4	1.6	-5.5	17 522	18 540	20 539	21 075	21 885
Lee	725	1 877	36 328	50.1	19.4	-4.3	-2.1	37 947	36 749	36 451	34 604	32 329
Lexington	1 046	2 708	41 381	39.6	15.3	1.7	0.9	40 690	40 341	37 809	38 638	39 092
Lewis	619	1 603	31 802	51.4	19.8	-5.2	-0.4	33 538	33 656	30 671	29 438	28 863
Madison	590	1 528	37 467	63.5	24.5	2.2	26.7	36 655	38 728	38 199	26 944	27 329
McHenry	417	1 071	147 897	243.7	94.1	32.6	32.5	111 355	86 218	50 656	37 311	35 679
McLean	1 185	3 069	119 149	100.5	38.8	14.1	24.5	104 389	88 877	76 577	73 930	73 117
McLean	581	1 506	131 375	226.1	87.2	5.1	5.7	125 018	118 257	98 853	84 684	81 731
Macoupin	865	2 240	49 384	57.1	22.0	10.8	2.4	44 557	44 536	46 210	46 304	48 788
Madison	728	1 885	247 691	340.2	131.4	-1.3	11.7	250 911	224 689	182 307	149 349	143 830
Marion	573	1 484	43 523	76.0	29.3	11.6	-0.9	38 986	39 349	41 700	47 989	25 635
Marshall	388	1 005	14 479	37.3	14.4	8.8	-0.2	13 322	13 334	13 025	13 179	13 023
Massac	536	1 389	19 492	36.4	14.0	20.5	4.5	16 180	15 193	15 326	15 328	15 115
Massac	241	623	14 990	62.2	24.1	7.9	-9.2	13 889	14 341	13 594	14 021	14 021
Massac	315	817	11 700	37.1	14.3	20.8	-4.7	9 485	9 348	9 439	10 663	10 575
Massac	539	1 408	19 284	34.5	13.3	11.5	0.8	17 294	17 149	17 374	17 701	16 641
Massac	388	1 006	20 117	51.8	20.0	6.8	21.4	18 831	15 307	15 282	12 754	12 389
Massac	705	1 826	31 684	44.9	17.4	4.7	-3.1	30 260	31 244	32 440	34 499	35 278
Montgomery	568	1 471	37 502	66.0	25.3	3.7	-1.1	36 174	36 571	35 568	36 378	34 248
Morgan	325	842	14 546	44.8	17.3	9.7	-2.7	13 263	13 635	15 171	15 477	13 247
McLean	799	1 967	46 338	61.1	23.6	8.1	12.5	42 867	38 106	33 429	29 889	28 118
McLean	630	1 607	200 464	323.3	124.7	2.6	3.3	195 318	189 844	174 347	153 374	141 344
McLean	442	1 146	21 714	49.1	18.9	9.9	3.0	19 737	19 184	21 684	23 438	22 767
McLean	439	1 137	16 381	37.8	14.6	6.9	3.7	15 509	14 988	13 970	14 659	15 38



**A COMPREHENSIVE EVALUATION OF THE OCCURRENCE,  
TRANSPORT, AND FATE OF GROUND WATER CONTAMINANTS  
IN THE LAKE CALUMET AREA OF SOUTHEAST CHICAGO**

**INTRODUCTION**

**Background**

Lake Calumet is located approximately 15 miles south of downtown Chicago, Illinois and 3 miles west of the Indiana border (figure 1). The Lake Calumet area has been the site of numerous industrial enterprises, from food processing to metal refining, since about 1860 (Colten, 1985). Originally, no control was exerted over the disposal of industrial wastes generated by these facilities. Quite often, Lake Calumet and the Calumet River served as the receptors of waste discharges, particularly liquid wastes. Solid wastes, composed largely of spoil dredged from the bottom of the Calumet River and Lake Calumet, mill slag, and other industrial wastes, were dumped on unused land or used to fill low-lying areas. Hundreds of acres of land in the area were reclaimed by this method (Colten, 1985).

In more recent times, regulatory controls have attempted to curtail such indiscriminate waste disposal practices. However, a declining economy, principally in the primary metals industry, has allowed a new type of industry to flourish. Waste disposal is now the dominant land use in the Lake Calumet area. At least 31 operating or retired landfills and waste handling facilities have been documented in the Lake Calumet area (Illinois Environmental Protection Agency, 1986). The largely unregulated industrial practices of the past combined with the industrial activities of the present, although regulated, provide an uncountable number of potential environmental hazards.

Certainly, industry is not totally responsible for the decline in environmental quality. Repeated political decisions have been made to locate waste handling facilities in this area. For example, the Greater Chicago Metropolitan Sanitary District (GCMSD) alone operates several waste treatment facilities in the Lake Calumet area. These facilities include wastewater treatment and associated sludge



drying operations, incineration and associated ash disposal, and large-scale landfilling operations. The decline in industrial expansion and the presence of large tracts of unused land throughout the area have increased the attractiveness of the area for waste disposal.

Until recently, the local population expressed little opposition to waste disposal practices in the Lake Calumet area. However, with the discovery of contamination in several domestic wells at homes not connected to public systems, the local citizenry has become organized to oppose the use of this area as a disposal ground for the rest of the Chicago area. They have begun to raise questions concerning the long-term health effects of the presence of the large volumes of hazardous wastes in or adjacent to their neighborhoods. Concerns have also been raised that past and present disposal practices have made the area unattractive to new industries which might consider moving into the area.

Further compounding this problem has been the inability of environmental regulations to fully protect the environment, or the health and welfare of the impacted population. For example, federal Superfund legislation emphasizes the protection of public water supplies. Because the primary source of drinking water for the Lake Calumet area is Lake Michigan, local ground-water problems do not rank high within current Superfund priorities.

Within the last five years, several studies (e.g., Colten, 1985; Illinois Environmental Protection Agency, 1986; and Ross et al., 1988) have been undertaken to improve our understanding of the threat posed by environmental stresses in the Lake Calumet area. Local citizens also have raised questions concerning the health risks posed to themselves and their families (Nelson, 1987). Many of the questions are unanswered and will remain so until more comprehensive investigations of the occurrence, fate, and transport of the environmental hazards in the Lake Calumet area can be completed.



Most recently, the Joint Committee on Hazardous Waste in the Lake Calumet Area (1987) made several recommendations designed to improve environmental conditions in the area. While the proposals are cross-cutting in their treatment of all environmental media (i.e., air, land, and water), prominent among them was the call for establishing a comprehensive ground-water monitoring network for the area. It must be recognized that ground-water monitoring, in itself, will not improve the environment. An effective monitoring program will, however, improve our understanding of the magnitude and extent of ground-water contamination so that better-informed decisions can be made concerning the proper corrective measures to implement. This proposal presents a plan to initiate a comprehensive, long-term ground-water monitoring program in the Lake Calumet area. This plan was developed by the Ground-Water Section of the Illinois State Water Survey (with support provided by the Illinois Hazardous Waste Research and Information Center, HWRIC) for consideration by the Illinois General Assembly.

#### **Geographic Features**

Lake Calumet is part of a much larger drainage system which will be described herein as the *Lake Calumet area*. In general, this area extends south from 95th Street to Sibley Boulevard and west from the Indiana state line to Martin Luther King Drive. The Calumet Expressway (I-94) passes immediately to the west of Lake Calumet; just east of the Indiana state line is the Indiana East-West Toll Road (I-90), which intercepts the Chicago Skyway at 106th Street and Lake Michigan. A large number of rail services crisscross the area including the Chicago, Rockford, and Pacific; the Illinois Central Gulf; the Penn Central; and the Norfolk and Western Railroads.

Topographically the area generally can be described as flat-lying and poorly drained. Natural, pre-landfilled, topographic relief was less than 10 feet. A unique exception to the flat topography is a knoll protruding approximately 20 feet above the general land surface just north of 95th Street. This knoll marks the location of the aptly named *Stony Island*, a geologic outcrop which played an important role in the formation of Lake Calumet.



The primary outlets for water from the Lake Calumet area are the Calumet, Grand Calumet, and Little Calumet rivers (figure 1). Surface drainage flows either to Lake Michigan or to the Illinois River Waterway through the Calumet Sag Channel. The O'Brien Lock and Dam located just south of Lake Calumet on the Calumet River controls the direction of flow on the river. Flow from Lake Michigan down the Calumet River and into Lake Calumet occurs when the gates at the lock and dam are open. When the gates at the lock and dam are closed, flow is from Lake Calumet toward Lake Michigan (Demissie et al., 1987).

The most recent USGS 7½' series topographic maps (photo-revised 1973) do not show the existence of, nor therefore the elevation of, the recently developed landfills. Without this information, potential changes in drainage patterns created by these man-made topographic features are largely unknown. Surface drainage patterns are further complicated by highway construction and facility storm drainage control. Drainage patterns play an important role in determining the movement of contaminants in surface runoff and in potential interaction with ground water. These patterns are presently being studied by the Surface Water Section of the Illinois State Water Survey under contract to the HWRIC.

#### **Geology and Ground-Water Resources**

The geology and ground-water hydrology of northeastern Illinois have been extensively studied and interpreted by several investigators (e.g., Suter et al., 1959; Willman, 1971; Visocky et al., 1985). Principal emphasis in recent years has been placed on declining ground-water levels in the Cambrian and Ordovician aquifers and the potential for water supply for northeastern Illinois communities (Schicht et al., 1976; Gilkeson et al., 1983; Sasman et al., 1982).

The geology of the Lake Calumet area is characterized by unconsolidated Quaternary material underlain by thick sections of sedimentary rocks. The Quaternary deposits are principally lake plain sediments, lacustrine silts and clays, and some sand and gravel. The



present Lake Calumet is a remnant of a higher Lake Michigan which receded to its present position over 10,000 years ago. The prehistoric lake receded, leaving a low, flat plain of lake-bottom fine silts and clays. The rocky knoll which marks the present location of Stony Island is believed to have deflected southerly-flowing water to the east, inhibiting the deposition of coarser materials beneath the Lake Calumet location (figure 2). Sandy beach ridges along Lake Michigan situated just to the east and south of Lake Calumet are further reminders of a once larger Lake Michigan.

Many of the surficial materials adjacent to Lake Calumet now consist of various man-made materials including demolition debris (e.g., concrete rubble and stone), incinerator ash, and solid waste. Depth to bedrock in undisturbed areas is approximately 65 to 80 feet. Depth to bedrock in some filled areas may exceed 125 feet. Well records indicate that thin deposits (i.e., 5 to 10 feet) of sand and gravel occur at the bedrock surface. These unconsolidated materials do not readily yield water to wells and are not considered a viable ground-water source even for domestic supplies, which require less water than industrial supplies.

The bedrock surface in the Lake Calumet area is dolomite of Silurian age (figure 3). Most small-capacity wells in the area are completed in the dolomite at depths of 300 to 400 feet. Depending on the size and frequency of the fractures encountered, well yields in the dolomite range from 5 to 30 gallons per minute.

Beneath the dolomite lies approximately 200 feet of Maquoketa Shale. The Maquoketa Shale is the major confining unit to underlying aquifers throughout northeastern Illinois. The Maquoketa Shale separates the dolomite from the underlying Glenwood-St. Peter Sandstone and deeper formations. The Glenwood-St. Peter constitutes the principal aquifer of the region. Large-capacity wells capable of producing at rates of greater than 500 gallons per minute have been developed in the Glenwood-St. Peter Sandstone and in underlying formations at depths of 1000 feet. According to Kirk et al. (1985),



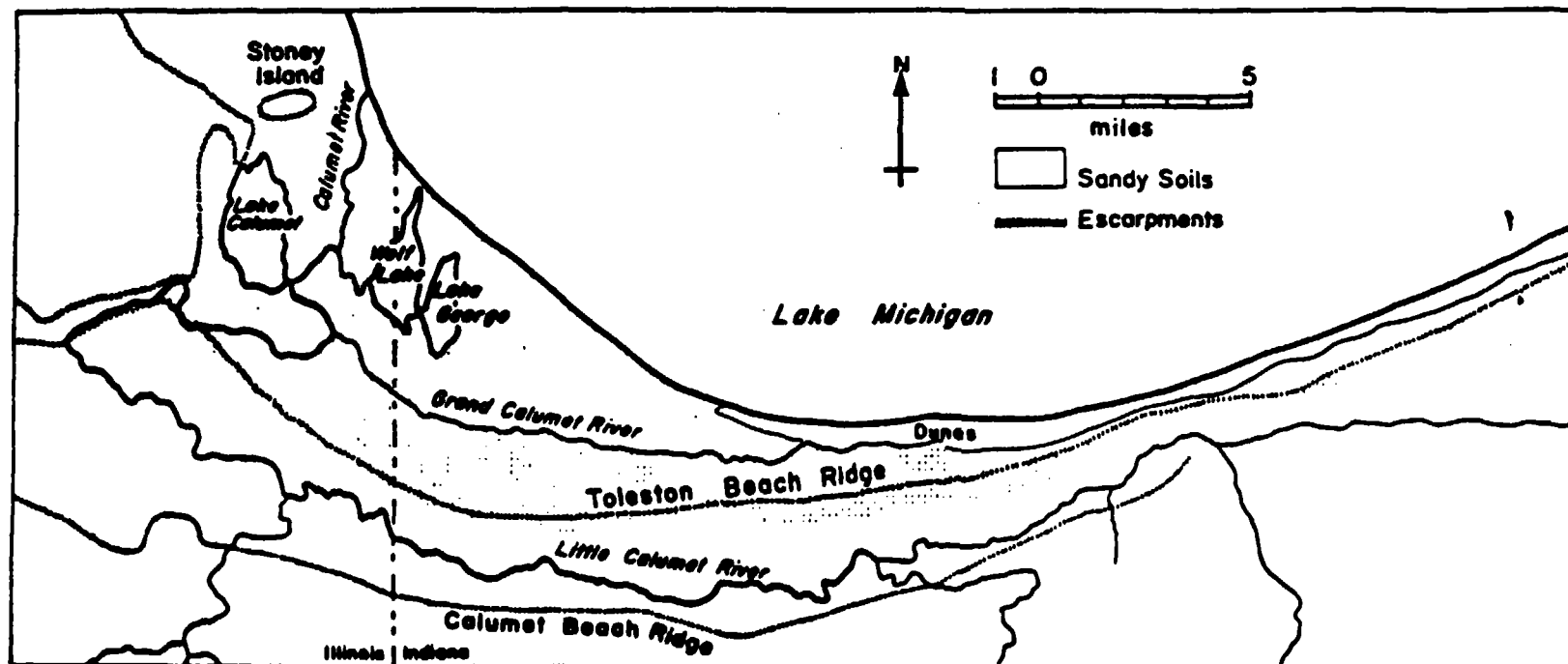


Figure 2. Calumet area topography (after Bretz, 1939)



total ground-water withdrawals in 1984 for the six townships surrounding Lake Calumet were only 244,000 gallons per day. Nearly all (more than 99 percent) of these withdrawals were due to industrial pumpage from Cambrian-Ordovician aquifers.

Because of the low elevation of the Lake Calumet area, the water table is very near the land surface. In general, the water table elevation can be readily observed by surface water elevations in Lake Calumet and surrounding ditches. Ground-water elevations in the dolomite wells range from 20 to 40 feet below ground surface, indicating an overall downward movement of shallow ground water to recharge the underlying bedrock. No studies have been conducted to map the direction of shallow ground-water movement near Lake Calumet or the amount of ground-water discharge into the lake. Similarly, no studies have evaluated the impact of local ground-water discharge on near-shore Lake Michigan water quality. This study will accomplish these goals.



# 1991 Indiana Fish Consumption Advisories

River, Stream or Lake	Fish Species Involved	Scope of Advisory
Clear Creek in Monroe Co.	All	2
Pleasant Run Creek and Salt Creek downstream of Monroe Reservoir Dam in Monroe and Lawrence Counties	All	3
Elliott Ditch and Wea Creek from its confluence with Elliott Ditch in Tippecanoe County	All	3
East Fork of White River from Bedford to Williams Dam	All	3
East Fork of White River below Williams Dam in Lawrence Co.	Carp	2
White River in Delaware Co. downstream from the Yorktown Bridge (C.R. 575W)	Carp	2
West Fork of White River from Noblesville to Hamilton/Marion County line	All	2
Stoney Creek downstream from Wilson Ditch south of Noblesville	All	3
Little Mississinewa River in Randolph County	All	3
Mississinewa River from one mile above the confluence of Little Mississinewa River and downstream to Ridgelyville	Carp Catfish	3 3
St. Joseph River in St. Joseph and Elkhart Counties	Carp	2
Maumee River below Ft. Wayne to state line	Carp	2
Sand Creek and Muddy Fork of Sand Creek near Greensburg and Decatur County Reservoir	All	2
Grand Calumet River, East and West branches, and the Indiana Harbor Ship Canal in Lake Co.	All	3
Wildcat Creek downstream of the Waterworks Dam in Kokomo to the Wabash River	All	3
Kokomo Creek in Howard Co. from U.S. 31 to Wildcat Creek	All	3
Little Sugar Creek in Montgomery Co.	All	3
Sugar Creek in Montgomery County south of I-74 to S.R. 32 bridge	All	3

## Lake Michigan and Tributaries Fish Advisory

Species	Advisory
Brown Trout under 23"	Group 2
Brown Trout over 23"	Group 3
Carp	Group 3
Catfish	Group 3
Chinook 21-32"	Group 2
Chinook over 32"	Group 3
Coho over 26"	Group 2
Lake Trout 20 - 23"	Group 2
Lake Trout over 23"	Group 3

## Ohio River Fish Advisory

Species	Advisory
Carp	Group 2
Channel Catfish under 19"	Group 2
Channel Catfish over 19"	Group 3

Advisories fall in three categories. A Group 3 advisory indicates that no one should eat designated species from named waterways. A Group 2 advisory means that adult men and women not of child-bearing age should consume no more than 1 meal per week consisting of up to one-half pound of flesh of designated species from named waterways. Women of child-bearing age and children under the age of 18 should not consume any of the fish listed in Group 2. Undesignated species in named waterways and all waterways not listed on the advisory receive a Group 1 rating, which means no consumption advisory is in effect.



## 1990 Sport Fish Health Advisories for Illinois Waters

### Organochlorine Contamination in Fish

Water Body	Level of Contaminants		
	Group 1-Low	Group 2-Moderate	Group 3-High
Lake Michigan	Lake trout up to 20" Coho salmon up to 26" Chinook salmon up to 21" Brook trout Rainbow trout Pink salmon Smelt Perch	Lake trout 20-23" Coho salmon over 26" Chinook salmon 21-32" Brown trout up to 23"	Lake trout over 23" Chinook salmon over 32" Brown trout over 23" Carp Catfish
Lake Springfield	White crappie Carp under 26" Flathead catfish under 16" Largemouth Bass	Bigmouth buffalo	Channel catfish Carp over 26" Flathead catfish over 16"
Lake Decatur		Channel catfish	Flathead catfish Bigmouth buffalo
Lake Taylorville		Carp	Channel catfish Bigmouth buffalo
Clinton Lake		Channel catfish	
Lake Bracken		Largemouth bass Bluegill Crappie	Carp Channel catfish
Crab Orchard Lake (west of Route 148)	Bullheads White crappie Largemouth bass Bluegill Channel catfish	Carp	
Crab Orchard Lake (east of Route 148)	Bullheads White crappie Bluegill Largemouth bass	Channel catfish Carp under 15"	Carp over 15"
Des Plaines River from Lockport to Kankakee River Confluence		Channel catfish Smallmouth buffalo Drum	Carp
Mississippi River headwaters to Starved Rock Dam			Carp
Mississippi River Des Moines River Confluence to Lock and Dam 20		Carp Channel catfish	
Lock and Dam 24 to Lock and Dam 25		Channel catfish	
Illinois River Confluence to Alton, IL		Channel catfish Carp	
Jefferson Barracks Bridge to Ft. Chartres, IL			Carp Channel catfish
Ft. Chartres to Cairo, IL		Carp Channel catfish	
Lock and Dam 22 to Cairo			Shovelnose sturgeon and sturgeon eggs
Group 1:	Lowest level of contaminants		
Group 2:	Moderate levels of contaminants; children, pregnant women, women who may become pregnant and nursing mothers should not eat Group 2 fish; all others should limit their consumption of these fish to one meal per week.		
Group 3:	High levels of contaminants; no one should eat Group 3 fish.		

## Questions about the taminant Monitoring

### What chemicals are tested?

The thirteen commercial pesticide lubricants listed in the following table and chlorine and are classified as organochlorine compounds. Chlordane, heptachlor, aldrin, and dieldrin have the same components but their structure further identifies them as cyclodienes. The identification of new source potential contamination, some whole fish analyzed for about 50 additional chemicals.

### Why were they selected?

The environmental toxicants list was selected for the routine fish tissue testing because they are widely dispersed in the environment, are persistent and common. Over time, these compounds have been cancelled or restricted by the U.S. EPA; however, they have remained in the environment over long periods of time. Their low solubility in water have resulted in contamination of the aquatic food chain.

### How are fish tested for contaminants?

A state fish contaminant monitoring program has been established. IDOC biologists sample fish from designated areas in the state. The samples are carefully prepared and sent to the IEPA laboratories for testing.

The U.S. Food and Drug Administration standard used in this program calls for testing a portion of the fish. The tissue sample is taken from the boneless, scaleless skin on the fillet of the fish. (Catfish and bloaters chubs are tested using a different protocol using gas chromatography-mass spectrometry to analyze the samples for contamination.)

The laboratory results are then compared to the USFDA tolerance levels and are used to determine whether to issue a health advisory.

### How are tolerance levels determined?

The USFDA has established acceptable chemical residues in fish called levels.



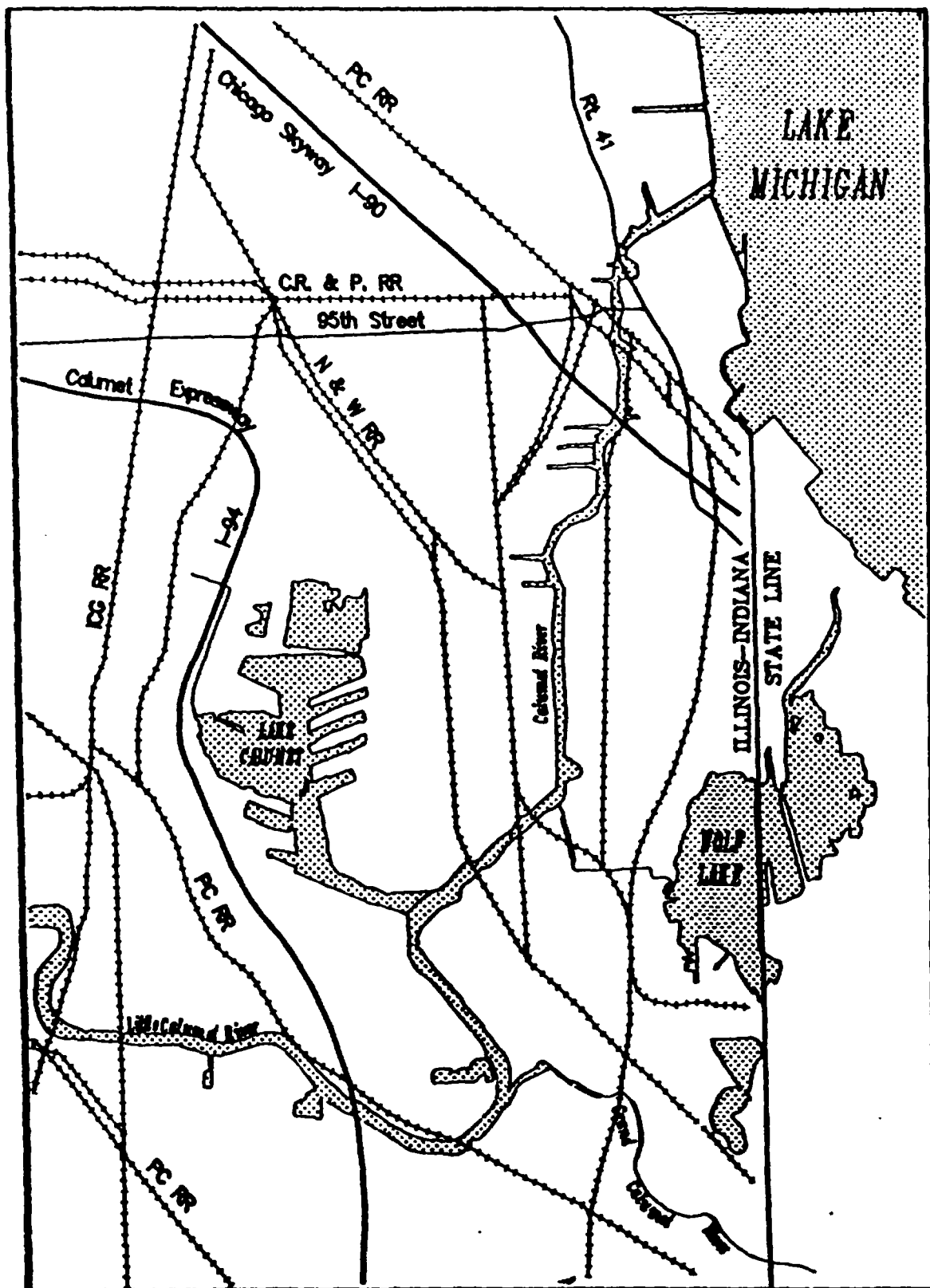


Figure 1. General Lake Calumet study area



UNIT 1  
Chiefly glaciolacustrine

Q1a

SAND, fine to medium, locally coarse, pebbly, and organically rich. Forms beach ridges and dunes that represent former strand lines. Includes man-made land along edge of Lake Michigan.

Q1b

SAND, fine to medium, silty, or clayey, locally organically rich. Forms relatively flat to slightly rolling plains between sand dunes and beach ridges.

Q1c

CLAY, silty, moraine, alternating with layers of tan silt, thinly laminated. Locally contains calcareous concretions and some sand.

UNIT 2

Q2a

TILL, silty clay, generally buff to tan in outcrop, somewhat sandy and pebbly. Forms upper part of the dissected ground moraine. Dissected pattern and the terminal moraines of the Valparaiso moraine system.

UNIT 3

Chiefly glaciolacustrine

Q3a

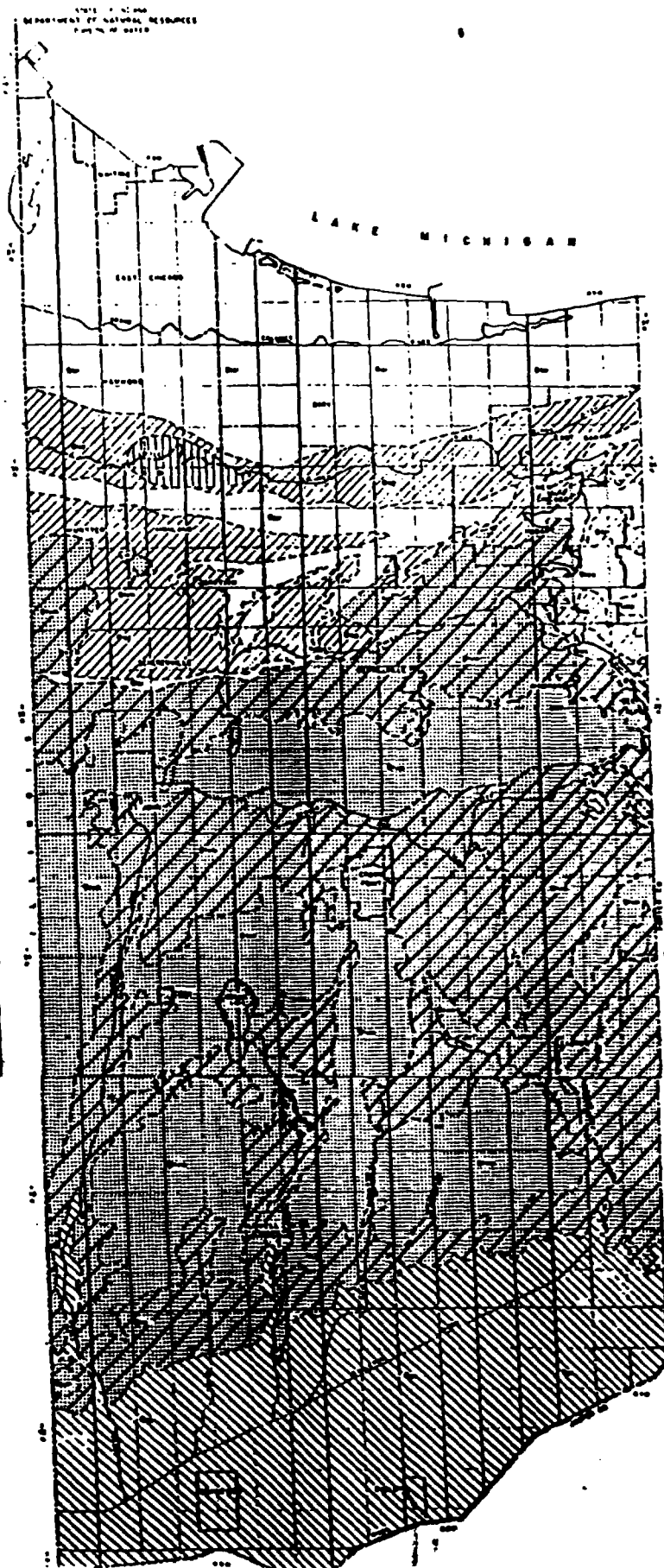
SAND, fine to coarse, somewhat silty, clayey, and organically rich. Locally interbedded with layers of organically rich silt and clay of relatively small areal extent. Contains small sand dunes.

UNIT 4

Q4a

TILL, hard, compact, gray clay with subangular to rounded pebbles.

Approximate contact, queried where less accurate.

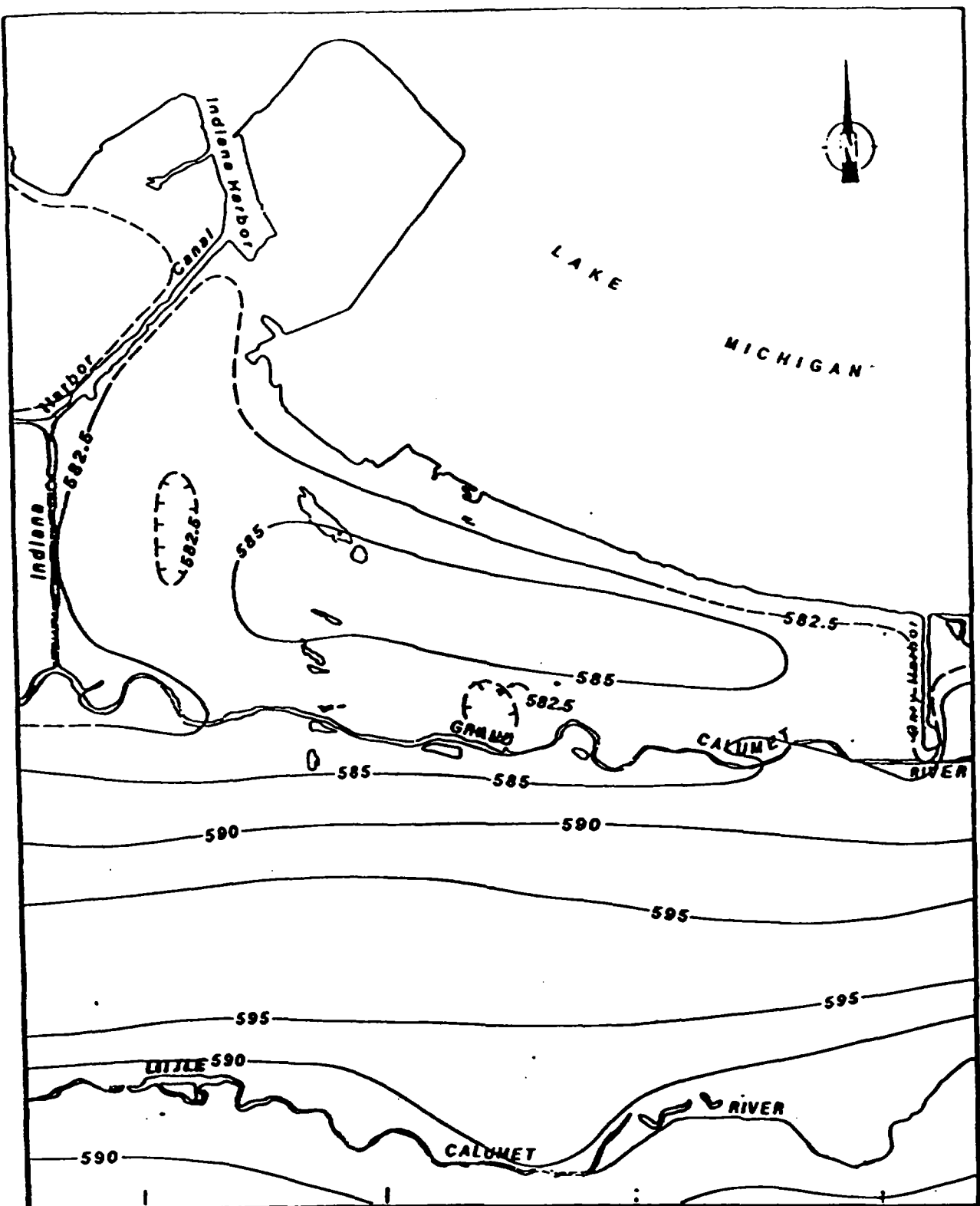






**FIGURE 2-4 SURFACE WATER IN THE VICINITY OF THE STUDY AREA**





SOURCE: USGS, Lee Watson, et al, Preliminary Analysis of the Shallow Ground-water System in the Vicinity of the Grand Calumet River/Indiana Harbor Canal, Northwestern Indiana, 1989.

FIGURE 4-3 REGIONAL GROUNDWATER ELEVATIONS IN THE VICINITY OF THE STUDY AREA



SYSTEM	SERIES	GROUP OR FORMATION	HYDROLOGIC UNITS	LOG	THICKNESS (FT.)	DESCRIPTION	
Quaternary	Pleistocene		Glacial drift aquifers		0-100+	Unconsolidated glacial deposits - pebbly clay (till), silt, and gravel. Alluvial silts and sands along streams.	
Pennsylvanian		Carbondale Tradewater			Absent	Shale; sandstones, fine-grained; limestones; coal; clay.	
Mississippian	Kinderhook				Absent	Shale, green and brown, dolomitic; dolomite, silty.	
Devonian					Absent	Shale, calcareous; limestone beds, thin.	
Ordovician	Silurian	Port Byron Racine Waukesha Joliet	Silurian		0-465	Dolomite, silty at base, locally cherty.	
		Alexandrian Edgewood					
	Cincinnati	Maquoketa	Maquoketa		0-250	Shale, gray or brown; locally dolomite and/or limestone, argillaceous.	
	Mohawkian	Galena Decorah Platteville	Galena-Platteville		220-350+	Dolomite and/or limestone, cherty. Dolomite, shale partings, speckled. Dolomite and/or limestone, cherty, sandy at base.	
		Glenwood					
	Chazyan	St. Peter	Glenwood-St. Peter		100-650	Sandstone, fine- and coarse-grained; little dolomite; shale at top. Sandstone, fine- to medium-grained; locally cherty red shale at base.	
	Prairie du Chien	Shakopee New Richmond Onota	Prairie du Chien		0-340	Dolomite, sandy, cherty (oolitic); sandstones. Sandstone, interbedded with dolomite. Dolomite, white to pink, coarse-grained, cherty (oolitic) sandy at base.	
	Cambrian	St. Croixian	Trempealeau	Trempealeau		0-225	Dolomite, white, fine-grained, geodic quartz, sandy at base.
			Franconia	Franconia		45-175	Dolomite, sandstone, and shale, glauconitic, green to red, micaceous.
			Ironton	Ironton-Galesville		105-270	Sandstone, fine- to medium-grained, well sorted, upper part dolomitic.
			Galesville				
			Eau Claire	Eau Claire (upper and middle beds)		235-450	Shale and siltstone, dolomitic, glauconitic; sandstone, dolomitic, glauconitic.
				Sandstones Eau Claire (lower) & Mt. Simon		2000+	Sandstone, coarse-grained, white, red in lower half; lenses of shale and siltstone, red, micaceous.
Mt. Simon							
Precambrian crystalline rocks							

Figure 3. Stratigraphic column for the Lake Calumet region (modified from Suter et al., 1959)



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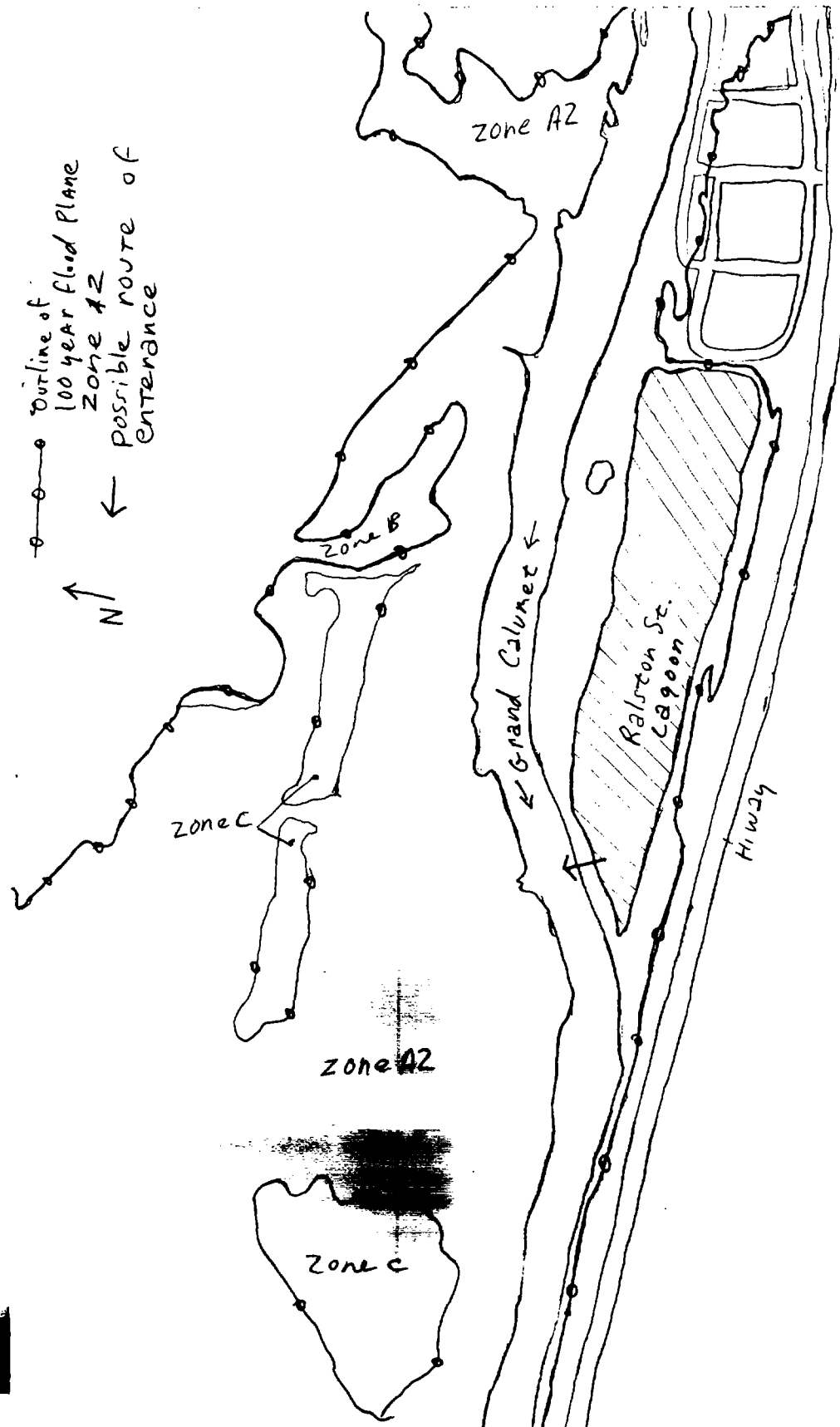
SURFACE WATER PATHWAY  
MIGRATION ROUTE SKETCH

Date: GSD Ralston St. 10  
7-29-91 Lagoon

Provide a Sketch of the Surface Water Migration Route:

(include runoff route, probable point of entry, 15-mile target distance limit, intakes, fisheries, and sensitive environments)

\* See fold-out map for 15-mile target distance.





	Average Concentration Range in Lagoon Contents *		
PCB	214.9	- 227.7	mg/K <sub>2</sub>
Lead	508.57	- 510.54	"
Zinc	1704.3	—	"
Copper	695.8	—	"
Cadmium	11.56	- 11.72	"
Nickel	65.5	- 67.9	"

\* Average % Solids = 7.2% [Ref 2]  
 Sampling performed May 4, 1983.



Gary Sanitary District  
Palston St. Lagoon.  
7-29-91 p 13a

## Gary-Hobart Water Intakes.

intake	Average intake rate-	%
Boreman Park	54. million gallons / day	69%
Ogden dunes*	24. million gallons / day.	31%

\* Outside 15-mile downstream distance.  
These intakes serve 188,000 people.

Hammond intakes are unblended,  
serve 204,039 people in Hammond,  
Munster, Highland Park, Lansing and  
Chicago Heights.

## Calculations

Boreman  
Park  
intakes

$$188,000 \times .69 = 129,720$$

$$129,720 + 204,039 = 333,759 \text{ people.}$$

[Ref. 5, 8].



## SITE HISTORY

The Raiston Street Lagoon is located 3/4 of a mile west of the Gary Sanitary District (GSD) wastewater treatment plant on the east branch of the Grand Calumet River. The lagoon was used by GSD for permanent disposal of raw and digested sewage sludge between 1962 and 1987 (Ref. 1). The lagoon has a capacity of 100 million gallons of sludge (Ref. 2). The lagoon is unlined, but is surrounded by an earthen levee (Ref. 2). The site is presently inactive (Ref. 3).

Sludge was observed seeping into the levee during an inspection of the lagoon by the Indiana State Board of Health in March of 1963. Also at this time the overflow mechanism was not working correctly, and the lagoon was nearly overflowing the levee (Ref. 4).

In May of 1963 Gulf Coast Laboratories collected samples from the lagoon sludge column between 0 and 25 feet. These samples contained an average PCB concentration of 214.9 to 223.7mg/kg; an average lead concentration 506.57 to 510.54 mg/kg; and elevated concentrations of cadmium, copper, nickel, and zinc. (Ref. 2)

In July of 1963 Sainsbury Engineering installed six monitoring wells on the GSD site. PCB levels in the range of 1.ppb were detected in one well. Other wells contained levels of cadmium between .02 and .00ppm (Ref. 2).

U.S. EPA and the State of Indiana filed suit against GSD in response to the 1963 sampling and inspections. GSD agreed to develop an alternative method for sludge disposal by May of 1987 (Ref. 2).

The lagoon lies within the 100-year flood plain of the Grand Calumet River. The levee on the west side of the lagoon is within forty feet of the Grand Calumet River Bank. Separating the lagoon from the river is a small palustrine wetland (Ref. 6, 9)

Toxins in the lagoon (PCB, Lead) could migrate to the Grand Calumet River in the event of a flood. Once released these toxins could enter the human food chain via accumulation in fish tissues (Ref. 19). Fishing in the Grand Calumet River is discouraged by the Indiana State Board of Health (Ref. 7).

The lagoon is located near the primary residential area of Gary, Indiana. Several houses are located within 200 feet of the lagoon, however the area around the lagoon is fenced (Ref. 3 ). Residents of Gary receive drinking water from two inlets in Lake Michigan. The Boreman Park inlet is approximately 10.2 miles downstream of the site and the Ogden Dunes inlets are outside the fifteen mile downstream arc of the site (Ref. 5, 8).

Toxins in the lagoon could leach into groundwater. The lagoon is located in an area of unconsolidated lacustrine sands and is unlined, however there is little use of ground water in the vicinity of the site. The closest residential well is approximately 3/4 miles from the site. Approximately 360 residents within four miles of the site rely on groundwater for drinking and household uses (Ref. 8, 9, 10, 16). Information on the depths of these wells is not available at this time.



### Groundwater Use

The water table in the vicinity of the site is between three and four feet beneath the surface (Ref 10). According to soil boring records the lagoon is sited in loose, fine textured sand mixed with beds of organic matter (Ref 2).

Residents within four miles of the lagoon are on municipal water systems which draw from Lake Michigan with the following exceptions: Thirty seven residents of Gary use private groundwater wells, the closest well is approximately 3/4 mile from the lagoon; and approximately 140 residents of Black Oak between 2.0 and 3.0 miles from the site also use private wells (Ref. 5, 8, 12, 14, 16, 17, 18).

Precise information on the aquifers these residents draw from is not available. The unconsolidated materials in the area; lacustrine sands and sandy glacial till mixed with beds of silty clay are between 50 and 300 feet thick and are an important source of groundwater in the area. Bedrock formations in the area are Ordovician dolomite and in some areas shale. These formations are not productive aquifers. Silurian dolomite beneath the bedrock is an important aquifer (Ref 20). The upper aquifer consisting of unconsolidated materials is the Aquifer of Concern.



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well is approximately 3/4 miles from the site. Approximately 660. residents within four miles of the site rely on groundwater for drinking and household uses (Ref. 8,12,14,16,22). Information on the depths of these wells is not available at this time. 18.